**Aristotle Rediscovered: What Exactly Is the "Mechanism" for Intelligent Design?**

***Michael Denton April 21, 2015 3:22 AM |***[***Permalink***](http://www.evolutionnews.org/2015/04/aristotle_redis095391.html)

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[](http://www.evolutionnews.org/2015/04/aristotle_redis095391.html)In a post yesterday, I responded to a question from Discovery Institute's Chairman of the Board, Bruce Chapman ("[A Maze with One Exit: Why Evolution Had No Choice](http://www.evolutionnews.org/2015/04/a_maze_with_one095351.html)"). He goes on to query me about how the direction in nature's evolution was imparted:

Darwinists often ask what they seem to regard as a killer question: If there is intelligent design, what is the mechanism for it? Of course it's possible to reply that the question is intended as a trap -- which it often is -- or the result of faulty thinking, a "category error," and that what ID does is not to identify a mechanism but rather the existence of agency. I'm not sure that suffices, though. What do you suggest?

Bruce alludes here to an important point: the evidence for intelligent design is not undermined by conceding that the mechanism by which the design was executed is not understood. However, this does leave the question unanswered as to how the evolutionary process was directed, or to put it another way, how the designs manifest in the biological world were actualized.

As I see it, at least part of the answer must involve a return to the pre-Darwinian typological view of nature and the conception that the entire tree of life and all its constituents types (or branches) were built into the order of things from the moment of creation and that special "laws of form" or natural agency -- Aristotle's substantial forms -- have directed the course of organic evolution over the past four billion years.

On such a view, the "types" (insects, mammals, man), or more specifically the ground plans or deep homologies or patterns shared by all the members of a type, would represent a finite set of changeless natural forms, as with atoms or crystals. The determining laws, the biological laws of form, would be analogous to the laws that determine forms in the inorganic world: laws of crystallography, laws of chemistry, etc. What this amounts to, of course, is a modern restatement of Aristotle's notion of forms as active agencies in nature, responsible for the generation of the particular set of biological forms or types manifest in life on earth.

Note that I am referring here to the generation by "laws of form" of *the underlying ground plans of the types* and *not the adaptations built upon these ground plans*.

So what is the evidence that nature is ordered to actualize the forms of life on earth, that is, for the existence of laws of form or Aristotle's *entelechies\**? What is the evidence that nature herself is the **ultimate directive agency**, that a designer's plan was enacted via natural agency?

Well, there are firstly two lines of circumstantial or indirect evidence. There is the failure of Darwinian bottom-up explanations of the origin of the types, particularly those patterns or body plans, etc., that appear to be non adaptive. Then there is the failure to provide a convincing explanation of development in terms of a set of instructions in the genes. These are not trivial failures. Insofar as mechanistic bottom-up explanations fail -- and cumulative selection and gene-directed development are bottom-up causal explanations for phylogeny\* and ontogeny\* respectively -- then the only available natural causal alternative account of the actualization of life's forms in phylogeny and ontogeny is to postulate the existence of directive forces in nature, that is, laws of form that have executed a designer's plan.

So both these failures point in the same direction. They result in a consilience of very powerful circumstantial evidence that leads back to laws of form and ultimately to Aristotle. In fact, these two primal failures are pretty straightforward predictions of Aristotle and the laws of form in biology of the pre Darwinian era. And as Sherlock Holmes pointed out, the true explanation of a phenomenon is the one that remains, however outré, after all other explanations have been excluded. If the evolutionary origin of "X" cannot be accounted for in terms of natural selection or development explained in terms of the genes, even after exhaustive attempts, then natural agency is the only "naturalistic" fallback position. In effect, an explanation positing "laws of form" wins by default.

Another line of circumstantial evidence, but one that is more positive, arises from the now widely accepted notion that that the cosmic environment is fine-tuned for life as it exists on earth. This environmental fine-tuning is in fact so extraordinary that it suggests almost irresistibly that the laws of nature will also turn out to be fine-tuned for the origin and actualization of the specific forms of life on earth. This again points to the existence of a set of **special generative biological laws of form**, or if you prefer, Aristotle's *entelechies*.

To me, these three lines of circumstantial evidence taken together seem conclusive. Only a paradigm based upon "laws of form" can provide a coherent and consistent explanatory framework for all three.

However, in addition there are more direct lines of evidence. Arising from recent advances in fundamental biological knowledge, this evidence too supports the existence of laws of biological form and the existence of a finite set of definite types as intrinsic natural features of the world order (as, again, with atoms and crystals). To begin with, as has been acknowledged since the early 19th century, the types are *very robust* and have persisted essentially as unchanged patterns or ground plans in diverse lineages for millions of years. Recent developmental studies have revealed additional aspects to this extraordinary robustness, showing that the types are generated during development in extraordinarily diverse ways, utilizing different genes, different gene circuits, different developmental modules, etc. In other words, the same end is achieved by *different means*, as dramatically witnessed, for example, in the different routes/genes/developmental mechanisms involved in the actualization of the insect body plan.

In addition, it is well established that the embryo is shaped by epigenetic\* biophysical and biomechanical forces and NOT by the genes. Yes, the genes provide the raw material -- base matter -- but it is the shaping of this raw matter by physical forces that gives us the specific architecture of the embryo. These forces arise from the emergent viscoelastic properties of individual embryonic cells and cell collectives -- layers of cells, clumps of cells, etc. Self-evidently the physical properties of one cell (the initial egg) are very different from the physical properties of a ball of cells (the morula), and a hollow ball (blastula) has different properties again.

This succession of unique physical properties in the developing embryo that occurs during ontogeny is not specified in the genome. What is also very intriguing about the biophysical and biomechanical forces that shape embryos is that they represent a clear case of top-down causation where the overall biomechanical state of the embryo influences downwardly the behavior and state of all the constituents in the embryo. Even the expression of genes is now known to be regulated to a degree by the mechanical state of the whole embryo itself and its constituent cells. Hence my interest in Aristotle's substantial agencies, which shape "base matter" into the higher architecture of life.

Consider the cell membrane. Even such a simple form is shaped by physical forces *external to the genes.*This iconic form is the result of a very important physical force, the hydrophobic force (by which water forces together non-polar solutes such as lipids of the membrane into insoluble clumps). The membrane film that spontaneously surrounds all living cells on earth does not form in a non-polar solvent such as ethane or any other organic solvent. In other words, a specific physical force external to the matter of the membrane and certainly not in the genes or specified by the genes is primarily responsible for shaping the cell membrane. Matter is important and the characteristics of matter are important but the final form is determined by a basic physical force or natural agency acting on the matter. It is this interaction between matter and*a natural agent external to it* that generates the architecture of the cell membrane.

Consider a simple analogy. The differing physical properties of a developing cell or embryo are analogous to the succession of different material properties of a mass of water as the number of individual molecules in increased. One molecule of water is insufficient to make a round drop of water. But billions will form a small drop, which will adopt a spherical shape fashioned by surface tension (a natural law). As the mass of the drop increases, it adopts a pear shape given by surface tension and the force of gravity on earth (two natural forces). As the amount of water in the drop increases, eventually gravity pulls it to the ground. If it falls into a pool of water, it makes a characteristic splash, a complex form that includes a short vertical liquid column that exists only for an instant and a series of small waves radiating out from the point at which the drop hits the water. Eventually, if the mass of water is sufficiently great, forming a pool of water or eventually an oceanic-sized body of water, wave forms may occur on the surface driven by the force of air moving over the water and the density of the water held under gravity.

In this example, different natural laws and different physical processes that apply to different masses of the same matter -- water -- generate a whole succession of forms. The matter is the same but the forces external to it *impose a diversity of shapes.*

Note also the change is not always continuous. The moment when the drop falls to the ground is a strikingly saltational outcome when a critical mass is reached. In the case of a developing embryo, the situation is far more complex because the matter of the embryo is changing as patterns of gene expression change. Consequently the physical forces that apply are far more complex. But at least to some degree, the analogy still holds.

It is too early to figure out just how constraining the various physical forces may be and just how many forms nature is allowed to craft out of the cellular matter of embryos. But the increasing acknowledgement that physics plays a critical role in shaping embryos is a very big step toward an answer. If physics does lend a hand in the making of organic form -- analogous to the way it shapes a drop of water -- I think it is a near certainty that it will turn out mother nature is a constraining mistress and that she will only permit a limited set of forms or types.

Finally, what was the mode of origin of the forms or types during evolution? One clue is provided by ordinary ontogeny and by the water-drop analogy. Some new properties might emerge gradually, as in the change from round to pear-shaped drop of water. In other cases, there may be a saltational change like that from pear-shaped drop to "splash." As I see it, laws of form may have exerted changes that were very gradual. Such was probably the case with the establishment of pentadactyly in the origin of the tetrapod limb. Or they may have done so very suddenly. Such was perhaps the case with the origin of human linguistic ability. In all cases change is non-Darwinian but executed by natural agency or law.

[*Image: Aristotle, via Wikicommons.*](http://commons.wikimedia.org/wiki/File:Aristotelesarp.jpg)

entelechy (plural entelechies) (Aristotelian philosophy) The complete realisation and final form of some potential concept or function; the conditions under which a potential thing becomes actualised.

A particular type of motivation, need for self-determination, and inner strength directing life and growth to become all one is capable of being. It is the need to actualize one’s beliefs. It is having a personal vision and being able to actualize that vision from within.

Something complex that emerges when a large number of simple objects are put together.

<https://en.wikipedia.org/wiki/Ontogeny> Wikipedia

Ontogeny (also ontogenesis or morphogenesis) is the origination and development of an organism, usually from the time of fertilization of the egg to the organism's mature form. Yet, the term can be used to refer to the study of the entirety of an organism's lifespan.

Phylogenetics - Wikipedia, the free encyclopedia https://en.wikipedia.org/wiki/Phylogenetics

branching process may be depicted as a phylogenetic tree, and the place of each of the various organisms on the tree is based on a hypothesis about the sequence in which evolutionary branching events occurred.

Epigenetics - Wikipedia, the free encyclopedia https://en.wikipedia.org/wiki/Epigenetics

In genetics, epigenetics is the study of cellular and physiological trait variations that are not caused by changes in the DNA sequence; in layman's terms, epigenetics is essentially the study of external or environmental factors that turn genes on and off and affect how cells read genes.